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TECHNICAL MEMORANDUM

Date: April 16, 2019 **BKF Job Number: 20160331-10**

Deliver To: **Anwar Mirza, PE**

From: **Mike O'Connell, PE**

Subject: **1325 Old County Road Sewer Calculations**

INTRODUCTION

The following memorandum presents calculations showing that the existing 8-inch main in O'Neill Avenue will support the proposed mixed use project at 1325 Old County Road. We recently received additional comments and a request from the City to update our sewer calculations based on the information provided by the City from the Belmont Village Specific Plan sewer model. The proposed development includes 250 residential units and a small amount of flexible space. The site is located within Sewer Sub-Basin 2.

EXISTING CONDITIONS

The existing site consists of five lots with three industrial/commercial buildings and two surface parking lots. The site is currently served by an 8-inch main in Old County Road and an 8-inch main in O'Neill Avenue owned by the City of Belmont. In addition, the site is served by a 6-inch main in Elmer Street. Ultimately, all wastewater flows are conveyed to the Redwood Shores Wastewater Treatment Plant.

EXISTING SANITARY SEWER DEMAND

The City of Belmont does not have published water demand or wastewater average daily flow factors. However, existing Average Dry Weather and Peak Wet Weather Flows were included in the model results provided by the City. The model results are below:

Table 1: Existing Flowrates

Existing PDWF (CFS)	Existing PWWF (CFS)
0.00	0.02

There are two existing sewer laterals that connect to the 8-inch main in O'Neill Avenue and one sewer lateral that connects to the 6-inch sewer in Elmer Street. All existing laterals will be removed as part of the development.

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PROPOSED CONDITIONS

The proposed development includes 250 residential units and below grade parking. A single 6-inch sewer lateral will serve the site and will connect to the existing 8-inch main in O'Neill Avenue.

Minimum design requirements are as follows:

- Sewer laterals shall be a minimum of ¼ inch per foot, or
- Sewer laterals shall be constructed on a slope to provide a minimum 2.5 feet per second.

PROPOSED SANITARY SEWER DEMAND

The Unit Factors we received from the City include a unit demand of 136 gpd/unit for High Density Residential.

The Average Dry Weather Flow is: 136 gpd/unit x 250 units = 34,000 gpd.

The project proposes to connect to Manhole MH 403329. The existing peaking factor for dry weather flow for this pipe is 1.45 and the future peaking factor dry weather flow for this pipe is 1.45.

Therefore, The Peak Dry Weather Flow is 1.45 x 34,0000 gpd = 49,300 gpd.

Figure 1: Peaking Factors from City Model

Pipe Model ID	GISID	From MH	To MH	Existing				Long-term Future				Existing		Future	
				ADWF (mgd)	PDWF (mgd)	PWWF (mgd)	PWWF Max. d/D	ADWF (mgd)	PDWF (mgd)	PWWF (mgd)	PWWF Max. d/D	PDWF Factor	PWWF Factor	PDWF Factor	PWWF Factor
2107	1729	403331	403329	0.0043	0.0062	0.0232	0.2203	0.0107	0.0154	0.0302	0.253	1.450	5.437	1.450	2.835
165	0	403329	403330	0.0071	0.0103	0.0728	0.2186	0.0283	0.0410	0.0962	0.251	1.451	10.281	1.451	3.402
40197	NA	403330	403312	0.0135	0.0196	0.1996	0.6059	0.0537	0.0778	0.2438	0.617	1.449	14.794	1.450	4.544
2218	1882	403312	403313	1.4398	2.0463	8.9169	0.7347	1.8099	2.3517	9.2641	0.786	1.421	6.193	1.299	5.119
2463	1949	403313	403314	1.4444	2.0524	8.9382	0.6908	1.8154	2.3585	9.2622	0.919	1.421	6.188	1.299	5.102
2471	2022	403314	403315	1.4429	2.0521	8.9544	0.8653	1.8138	2.3600	9.2869	1.000	1.422	6.206	1.301	5.120
2454	2083	403315	403406	1.4395	2.0484	8.9708	1.0000	1.8100	2.3569	9.3039	1.000	1.423	6.232	1.302	5.140
2473	2165	403406	403407	1.4397	2.0487	8.9829	1.0000	1.8102	2.3572	9.3231	1.000	1.423	6.240	1.302	5.150
2455	2234	403407	403708	1.4372	2.0461	8.9953	1.0000	1.8075	2.3550	9.3420	1.000	1.424	6.259	1.303	5.169
2456	2241	403708	403709	1.4378	2.0473	9.0131	1.0000	1.8084	2.3561	9.3619	1.000	1.424	6.269	1.303	5.177
275	0	403709	403423	1.4373	2.0474	9.0302	1.0000	1.8082	2.3569	9.3798	1.000	1.424	6.283	1.303	5.187
266	0	403423	N/A	1.4341	2.0551	9.0794	0.9503	1.7932	2.3613	9.4371	0.993	1.433	6.331	1.317	5.263
264	N/A	N/A	400010	2.3840	3.4733	16.1005	0.7416	2.9880	4.2153	17.9510	0.826	1.457	6.754	1.411	6.008
247	0	400010	12	2.3907	3.4750	16.1095	0.6548	2.9937	4.2265	17.9638	0.720	1.454	6.738	1.412	6.000
CDT-11	0	12	N/A	2.4436	3.5398	16.5845	0.1437	3.1771	4.4932	18.4825	0.151	1.449	6.787	1.414	5.817

The peak hourly flow can be based on an effective 12 hour day. Therefore the peak hourly dry weather flow is 49,300 gpd / 12 hours / 60 minutes per hour = 69 GPM or 0.15 CFS.

The peaking factor for wet weather flow is 10.28 per the model results provided by the City. Therefore, the Peak Wet Weather Flow is 10.28 x 34,000 gpd / 12 hours / 60 minutes per hour = 485 GPM or 1.08 CFS. This is conservative because as noted in the City's analysis, the future Peaking Factor for wet weather flow will be reduced from 10.28 to 3.40.

CAPACITY OF EXISTING SEWER MAIN

The design criteria provided by the City is that for existing mains 12-inches diameter or less the depth of the peak flow shall not exceed the 70% of the diameter of the pipe. The existing main is 8-inches so the peak flow depth is limited to 0.70 x 8 = 5.6-inches. The existing sewer main has a slope of 1.8% and is Vitrified Clay Pipe. The depth of flow in the pipe at the peak flow of 485 GPM is 4.78 inches which is less than the maximum allowable depth of 5.6-inches, as shown in the calculations below.

1325 Old County Road Sewer Memo

PIPE VELOCITY AND FLOW
Using Manning's Equation for Pipe Flow

Project	1325 Old County Road	**Location**	8-Inch Main on O'Neill
Calc By	MAO	**Date**	4/15/2019

Equations

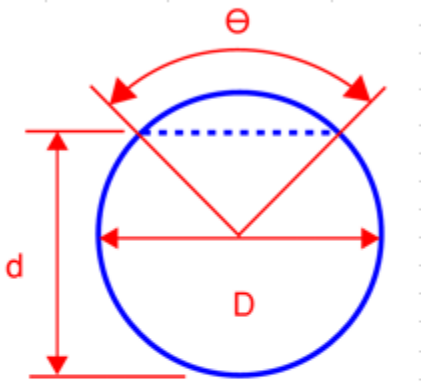
$Q=(1.486/n)AR_h^{2/3}S^{1/2}$

$V=(1.49/n)R_h^{2/3}S^{1/2}$

$Q=V \times A$

Definitions

Q=Pipe flowrate (cubic feet per second)
V=flow velocity (feet per second)
D=pipe diameter (inches)
d=depth of flow (inches)
R_h=A/P = hydraulic radius (feet)
A=cross sectional area (square feet)
P=wetted perimeter (feet)
S=slope of channel (ft/ft)
n=Manning's roughness coefficient



Pipe Characteristics

D=	8.0	inches	θ=	157.7	degrees
d=	4.78	inches	A=	0.22	square feet
material=	VCP		P=	1.18	feet
n=	0.013		R_h=	0.18	feet
S=	0.0180	ft/ft	d/D=	0.596875	

Pipe Velocity and Flow — **Oneill Avenue - Pipe Demand**

Velocity (ft/s)	Flow (cfs)	Flow (gpm)	Existing Flow (gpm)	Proposed Flow (gpm)	Total Flow (gpm)	Percent Full
4.97	1.08	485	0.00	485.00	485	60%

SUMMARY

The existing 8-inch main in O'Neill Avenue will meet the City's requirements for maximum depth of flow during the proposed conditions.

Please contact me at 415.930.7957 or moconnell@bkf.com if you have any questions.

Sincerely,

Mike O'Connell, PE
Associate